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Managing the digital supply chain: The role of smart technologies

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ABSTRACT

This study investigates the approach required to achieve competitive advantages in the digital supply chain. Moreover, the study examines how digital transformation of companies can fuel smart technologies, leading to improved relationship performance. The results of the survey given to 280 Finnish small and medium-sized enterprises (SMEs) show that digital transformation of the companies alone cannot enhance relationship performance, and that it needs to be coupled with smart technologies to achieve this goal. This means that smart technologies fully mediate the relationship between digital transformation and relationship performance.

1. Introduction

Digitalization has changed the ways in which people communicate and interact with their surroundings. Novel technologies and gadgets—including smartphones, computers, driverless cars, and smart wearable devices—have all transformed how we access and disseminate information. These novelties and digital transformations affect every industry, and supply chains are no exception. Digitalization in supply chains has come to encompass digital products and services as well as the handling of supply chain processes within companies undergoing these rapid changes (Büyüközkan and Göçer, 2018). In order to benefit from the digital supply chain, it is necessary to leverage novel approaches, including digital transformation with technologies. This study defines the digital supply chain as a bundle of interconnected activities, handled with novel technologies, involved in supply chain processes between suppliers and customers (Büyüközkan and Göçer, 2018). In other words, the digital supply chain is an intelligent, value-added, novel process that utilizes new approaches, specifically digital transformation with technologies, to create competitive value and network effects (Büyüközkan and Göçer, 2018). Companies' digital transformations allow them to benefit from extra features, including barcode scanning, services offered based on location, and near-field communication (Ström et al., 2014). These activities are made possible by smart technologies, a group of characteristics embedded in devices that enable intelligence. These characteristics allow devices to be programmable, addressable, sensible, communicable, memorizable and associable (Yoo, 2010). Therefore, this study considers the digital supply chain built on both digital transformation and smart technologies, a context in which digitalization will change the way firms collaborate and interact (Akter et al., 2016; Büyüközkan and Göçer, 2018; Matt et al., 2015; Weichhart et al., 2016; Zhu et al., 2015).

Many researchers have highlighted the importance of both internal and external relationship performance in managing the entire supply chain (Stank et al., 2001; Holweg et al., 2005). For example, Stank et al. (2001) observed that increased collaboration among supply chain participants reduces total costs and augments service performance. They also found that, ideally, collaboration begins with customers and extends throughout the firm—from the distribution of finished goods to the manufacturing and procurement of raw materials to work with material and service suppliers. Studies also have indicated that increased digital transformation has given rise to increased collaboration within supply chains (Kiel et al., 2017; Klein and Rai, 2009; Nordman and Tolstoy, 2016; Zhao et al., 2015). Although many firms have mentioned and validated the great potential of digitalization in supply chains, there remains a substantial untapped possibility when it comes to companies seeking to move toward a digital supply chain (Büyüközkan and Göçer, 2018). Because there is a lack of evidence regarding how digital transformation increases collaboration (Scuotto et al., 2017), further investigation is needed into the role of smart technologies in the digital supply chain (Büyüközkan and Göçer, 2018). In this study, relationship performance includes both internal and external relationships, where the former refers to success in internal production, processes, communication, while the latter addresses the success of operations with other participants in a supply chain (Klein and Rai, 2009; Trainor et al., 2014).

Based on the abovementioned gaps, this study will shed light on the required approach to attain value-driven benefits in the digital supply chain. Specifically, the study investigates the mediating role of smart technologies between digital transformation of companies and relationship performance (in the digital supply chain). This study was

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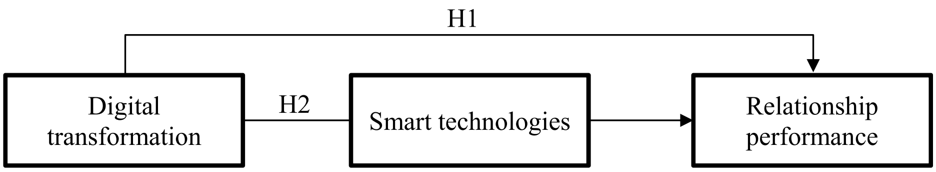

Fig. 1. Conceptual model.

conducted through a structured survey of 280 small and medium-sized enterprises (SMEs) in Finland. This study contributes to research on the digital supply chain by clarifying the relationship between digital transformation of companies, smart technologies, and relationship performance in practice.

This research proceeds as follows: First, the research starts with an introduction to briefly explain and highlight the significance of this research in the digital supply chain context. Second, the theoretical framework and research model will be presented, which deal with the development of hypotheses and a conceptual model of the digital supply chain, digital transformation of the companies, and smart technologies. The third section includes the research methodology, including sample and data gathering and construct operationalization as well as data analysis, validity, and reliability. Then, the results of the study will be described. Finally, the study will finish with the discussion and conclusions, which include theoretical and managerial implications as well as limitations and further research.

2. Theoretical framework and research model

2.1. The digital supply chain

For decades, firms have considered collaborative relationships as opportunities to make sure that their supply chain is effective and responsive to market transitions. Many companies, such as IBM, Dell, Hewlett-Packard, and Procter & Gamble, were able to achieve competitive advantages and lower transaction costs through strong long-term relationships with their partners (Cao and Zhang, 2011; Sheu et al., 2006). Based on previous research, collaborative relationships enable risk sharing (Kogut, 1988), complementary resources accessibility (Dwyer et al., 1987; Klein and Rai, 2009), productivity enhancement (Klein and Rai, 2009), and profitability (O'Toole and Donaldson, 2002) during the time. In this study, we define relationship performance as the appropriate level of collaboration, both internally and externally, between companies and their suppliers, built for conducting business (Akter et al., 2016; Büyüközkan and Göçer, 2018). Internal collaboration includes activities such as internal production, processes, and communication among employees inside the companies, while external collaboration encompasses the abovementioned operations with other participants outside the firms, in the supply chain (Klein and Rai, 2009; Trainor et al., 2014).

Organizations around the world have turned their attentions to digitality because of the considerable benefits it brings for firms. A huge number of benefits of utilizing digitalization in supply chains exists, many of which are still largely untapped. The reason could be the disruptive nature of organizational transformations, which might cause managers to neglect them and delay the processes (Büyüközkan and Göçer, 2018). Digitality has changed the way that both companies and individuals interact and communicate with each other in an extreme way (Berman, 2012; Büyüközkan and Göçer, 2018; Matt et al., 2015). Therefore, in order to exploit digitalization in business, companies should consider all the necessary procedures, strategies, and tools needed to move toward the digital supply chain (Akter et al., 2016; Büyüközkan and Göçer, 2018; Matt et al., 2015; Weichhart et al., 2016; Zhu et al., 2015). In this study, the digital supply chain is defined as a bundle of interconnected activities that are involved in supply chain processes between suppliers and customers, which are handled with novel technologies (Büyüközkan and Göçer, 2018). The digital supply chain enables wider availability of information and infinitely superior interactions, communication, and collaboration, which lead to improved trust, agility, and productiveness (Büyüközkan and Göçer, 2018; Liu et al., 2013). The digital supply chain needs a combination of digital tools, strategies, and approaches, which support interactions between customers and suppliers externally, as well as employees internally. In order to reap the benefits of the digital supply chain, there is a need to leverage novel approaches, including digital transformation with technologies. Therefore, the digital supply chain built on both digital transformation and smart technologies (Akter et al., 2016; Büyüközkan and Göçer, 2018; Matt et al., 2015; Weichhart et al., 2016; Zhu et al., 2015).

Digital transformation is defined as the transformation of business process, culture, and organizational aspects to meet market requirements, owing to digital technologies. In other words, it is the rethinking, reimagining, and redesigning of business in the digital age (Hinings et al., 2018; Li, 2018; Li et al., 2018; Matt et al., 2015; Pramanik et al., 2019). Digital transformation of companies involves fundamental changes in business process, including digitalizing everything that can be digitalized (Hagberg et al., 2016), collecting massive volumes of data from different sources (Leviäkangas, 2016; Frank et al., 2019), stronger networking among business processes using digital technologies (Berman, 2012; Matt et al., 2015), creating an efficient customer interface (Berman, 2012; Li et al., 2018; Matt et al., 2015; Pramanik et al., 2019), and information exchange based on digitality (Berman, 2012; Frank et al., 2019). Because of the key role of digital technologies in digital transformation, companies need to improve the level of technical adaptability and implement digital technologies appropriately (Frank et al., 2019; Pramanik et al., 2019).

Smart technologies refer to entities where physical devices or processes are complemented with the smart properties of digital technologies. Yoo (2010) has used the term "digitalized artifacts" to describe the necessary and desirable properties of artifacts to be digitalized for such smart technologies. In this sense, smart technologies are defined by certain key characteristics, including programmability, addressability, sensibility, communicability, memorizability, and associability in devices that make interconnectivity and intelligence of companies possible. Programmability enables devices to perform many different functions with more flexibility. Addressability enables devices to be identified and recognized uniquely. Sensibility makes devices able to react and be aware of changing circumstances. The communicability characteristic of devices enables them to interact with each other in a way that allows them to send and receive messages. Regarding memorizability characteristics, the devices have a type of memory chip, which collects and stores all the information. Finally, associability makes it possible for devices to be associated with other entities including devices, locations, and people (Yoo, 2010). Smart grids provide one example of these smart technologies; these modern power grids integrate multiple ICTs and services with the existing power delivery infrastructure (e.g., Featherston et al., 2016).

2.2. Importance of digital transformation in the digital supply chain

Collaboration, both internal and external, makes up an important part of companies' relationship performance in the digital supply chain. Digital transformation driven, for example, by increased automatization, data collection, information exchange, and networking, has created opportunities and challenges for company collaboration activities

Table 1
Results of the validity and reliability tests.

Latent variable	Measured variable	Standardized weight	Alpha	AVE	CR
Digital transformation (Berman, 2012; Frank et al., 2019; Hagberg et al., 2016; Leviäkangas, 2016; Li, 2018; Li et al., 2018; Matt et al., 2015; Pramanik et al., 2019)	We aim to digitalize everything that can be digitalized.	.570	.808	.471	.814
	We collect large amounts of data from different sources.	.644			
	We aim to create stronger networking between the different business processes with digital technologies.	.843			
	We aim to enhance an efficient customer interface with digitality.	.727			
	We aim at achieving information exchange with digitality.	.615			
Smart technologies (Yoo, 2010)	All the devices are programmable.	.837	.945	.742	.945
	All the devices are able to be uniquely identified.	.712			
	All the devices are aware of and respond to changes in their environment.	.805			
	All the devices can send and receive messages.	.942			
	All the devices can record and store all information.	.929			
	All the devices can identify with other devices, places, or people	.920			
Relationship Performance	Assesses internal collaboration over the last three years.	.780	.597	.462	.627
	Assesses external collaboration over the last three years.	.562			

(Riemer and Schellhammer, 2019; Singh et al., 2018). According to Riemer and Schellhammer (2019), the ability to collaborate and exchange information has provided new forms of working and also new types of virtual organizations, which have given companies the need to adjust their operations.

Digital transformation has revolutionized the possibilities and solutions for companies to handle and execute their external collaboration activities in the digital supply chain (Crittenden et al., 2019). Even though different types of social media solutions have changed the way people communicate, contemporary devices can also be identified and contacted by other devices or people. As such, digital transformation can enable the acquisition of external collaboration, and reduce engagement costs (Crittenden et al., 2019). In relation to external collaboration activities in the digital supply chain, digital transformation can also improve customer service as it enables the collection of large amounts of data from different sources and their utilization in building strong networks between different partners. Digital transformation also makes it possible for consumers and end-users to become experts on product and service offerings (Berman, 2012).

In addition to possibilities for external collaboration in the digital supply chain, digital transformation provides possibilities for internal collaboration within companies. Digital transformation can, for example, support collaborative work for planning and executing business processes (González-Rojas et al., 2016), as there is a possibility to exchange information and make everything digitalized. Even though the internal collaboration activities are difficult to handle without face-to-face communication, and companies require new types of capabilities to utilize the possibilities provided by digital transformation (Riemer and Schellhammer, 2019), the provided options can, for example, ease the establishment of a collaborative work environment (Boudreau et al., 2014; Merschbrock and Mundvold, 2015), where different people can operate. Based on the argumentation presented above, the following hypothesis is presented:

H1. Digital transformation of companies has a positive effect on relationship performance

2.3. Importance of smart technologies as a mediator in the digital supply chain

Digital transformation refers to fundamental changes in business processes, including digitalizing everything that can be digitalized (Hagberg et al., 2016). One key goal for digital transformation is stronger collaboration among business processes using smart technologies (Berman, 2012; Matt et al., 2015). The benefits of smart technologies are clearly indicated by the growing prospects of combining software and software components and mixing content across platforms, infrastructures, and production systems (Langlois, 2003; Merrifield et al., 2008; Yoo et al., 2010; Kallinikos et al., 2013). This indicates that smart technologies may be needed to fully exploit the possibilities of digital transformation. Smart technologies extend internet-based services by incorporating technologies, such as mobile operating systems (Nylén and Holmström, 2015), which support several service functions, including organizational service management, collaboration management, customer service support, as well as service research and planning (Chen et al., 2006; Loukis et al., 2012; Chuang and Lin, 2015). An example of the use of smart technology is a digital platform that integrates back-end enterprise resource planning (ERP) systems with front-end web-based systems and across different partners, in order to support e-business initiatives (Hsu, 2013; Zhu et al., 2015). By effectively managing interactions with partners and gaining shared key knowledge across organizational boundaries, smart technologies (in terms of an integrated digital platform) affect the development of procurement, channel management, and customer service (Devaraj et al., 2007; Zhu et al., 2015). Based on the above considerations, it can be assumed that in order to facilitate digital

Table 2
Correlation matrix.

	Mean	St. Dev.	Digital transformation	Smart technologies	Relationship performance
Digital transformation	5.11	0.975	.687[a]		
Smart technologies	3.76	1.641	.519***	.861[a]	
Relationship performance	2.86	0.501	-.008	.248**	.680[a]

[a] Square root of AVE, Sign. *** ≤0.001, ** 0.001 < p ≤ 0.01.

Table 3
Unstandardized maximum likelihood estimates (N = 280).

Structural path	Estimate	S.E.	C.R.	P
Relationship performance < — Firm size	-.001	.001	-.930	.352
Relationship performance < — Firm age	.000	.001	.099	.921
Relationship performance < — Type of business	.036	.100	.363	.717
Relationship performance < — Digital transformation	-.093	.048	-1.952	.051
Relationship performance < — Smart technologies	.095	.026	3.616	***
Smart technologies < — Digital transformation	.920	.113	8.130	***

Sign. *** ≤0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05.

transformation of companies, smart technologies are needed for better relationship performance. Thus, the second hypothesis is as follows:

H2. Smart technologies mediate the relationship between digital transformation of the companies and relationship performance

2.4. Conceptual model

This study investigates the smart technologies through which digital transformation of companies influences relationship performance in SMEs. Fig. 1 shows the conceptual model. To sum up, prior literature suggests that digital transformation can lead to improved relationship performance (Crittenden et al., 2019; Riemer and Schellhammer, 2019). Digital transformation is about companies' capability to use digitality for the benefit of their operation, and this depends on the characteristics of the digital tools adopted. Consequently, this study proposes smart technologies as an important tool to turn digital transformation of a company into increased relationship performance. This is because it is widely accepted that relationships are strongly affected by digitization (Jonsson et al., 2018), but certain properties need to be instantiated (Yoo, 2010) to gain relationship performance. Thus, the presence of smart technologies acts as a prompt for SMEs to gain relationship performance by means of digital transformation.

3. Research methodology

3.1. Sample and data gathering

Data collection was conducted as cross-sectional random sampling of SMEs located in Finland. The companies operate in a variety of service and manufacturing sectors, such as engineering, information technology, real estate, consulting, construction, accounting, and health services. From a sample of 5830 companies, 280 responses were obtained. The respondents were all in a managerial position, which provided them with good knowledge to respond to items related to digital transformation, smart technologies, and relationship performance at a company level.

The majority of companies (around 71%) were small with fewer than 50 employees, and the rest (around 29%) were medium-sized. Reported company ages indicated that about 37% of the companies were established fewer than 25 years ago. The remaining 63% of the companies were more mature (with more than 25 years since their establishment). The majority of the companies concentrated on business to business (B2B) trade (84%), whereas 16% of firms earned their revenue from business to customer (B2C) trade.

We tested the potential for nonresponse bias by building on Armstrong and Overton's (1977) suggested uniformity between nonrespondents and late respondents. The tests showed no significant divergence between early and late respondents, which demonstrates the nonexistence of nonresponse bias.

3.2. Construct operationalization

All items were adopted from previously utilized scales. Digital transformation was measured by five items that rated the companies' ability to use digitality in their operation. Digital transformation was identified by the following items: "In our company, we aim to digitalize everything that can be digitized," "In our company, we collect massive volumes of data from different sources," "In our company, we aim to create stronger networking between the different business processes with digital technologies," "In our company, we aim to enhance an efficient customer interface with digitality," and "In our company, we aim at achieving information exchange with digitality." This construct was built based on prior literature (Berman, 2012; Frank et al., 2019; Hagberg et al., 2016; Leviäkangas, 2016; Li et al., 2018; Matt et al., 2015; Pramanik et al., 2019). The construct for smart technologies included the following items: "In our company, all the devices are programmable," "In our company, all the devices are able to be uniquely identified," "In our company, all the devices are able to respond to changes in their environment," "In our company, all the devices can send and receive messages," "In our company, all the devices can record and store all information," and "In our company, all the devices can identify with other entities (e.g., other devices, places, or people)." This construct was based on the work of Yoo (2010). The response scale for the items of digital transformation (independent variable) and smart technologies (mediating variable) ranged from 1 to 7 (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = agree, and 7 = strongly agree). The dependent variable, relationship performance, was assessed by the state of collaboration both internally and externally. The response scale included managers' perceptions in the range of 1–4 (1 = weak, 2 = satisfactory, 3 = good, and 4 = excellent). In terms of control variables, well-established companies probably have sophisticated practices in terms of both internal and external collaboration, and such companies are also probably larger and older. Thus, the influence of firm size (assessed by the amount of employees) and firm age (assessed by the number of years since the company's establishment) on relationship performance was controlled. The third control variable was the type of business, which was assessed with a dummy variable divided into B2B and B2C companies.

The potential for common method variance was addressed as the data for each item were collected from the same source. Both ex ante and ex post remedies were employed (Podsakoff et al., 2003). Items of different variables were placed in a way that reduced the possibility of the respondent anticipating causalities. The introductory letter explained that the survey was anonymous which was likely to prevent the respondent from providing socially acceptable responses instead of the corporate reality. Also, Harman's one-factor test was employed. More than one factor emerged and the prior factor accounted for less than half of the variance, which provides the evidence for the lack of common method variance.

3.3. Data analysis, validity, and reliability

Confirmatory factor analysis (CFA) was utilized to check the reliability and validity of the constructs. Table 1 demonstrates standardized loadings, Cronbach's alpha (α), average variance extracted (AVE), and composite reliability (CR) values for each construct. The reliability of the scales was validated through Cronbach's alpha. The alpha values for digital transformation and smart technologies suggest the admissible level of reliability. The alpha value for relationship performance is lower (0.597), but according to Hair et al. (2006), values near 0.60 are acceptable, especially if the factor only has a few items. Convergent validity was estimated via factor loadings, CR, and AVE. Each loading was significant. CR values were significantly higher than the cutoff of 0.60 (Fornell and Larcker, 1981). The AVE value for smart technologies was more than the cutoff of 0.50, but the AVE values for the digital transformation scale and relationship performance were 0.471 and 0.462, respectively, which are slightly below the cutoff. However, we consider the AVE value to be at an acceptable level as the CR was above the threshold (Fornell and Larcker, 1981). Discriminant validity was estimated by collating the AVE and maximum shared variance (MSV) values. All MSV values were smaller than the AVEs, which supports discriminant validity. Thus, the validities of the study constructs are supported.

Moreover, Table 2 presents the means, standard deviations, and variable correlations. The high mean for digital transformation substantiates a wide adoption of digitality in SMEs. However, the mean for smart technologies is significantly lower. The correlations between the variable pairs were at an acceptable level.

4. Results

Fit indices of the model are calculated using multiple criteria, including ($\chi2/DF = 2.286$), the comparative fit index (CFI = 0.943), the incremental fit index (IFI = 0.944), the normed fit index (NFI = 0.904), and the root mean square error of approximation (RMSEA = 0.068). Based on a rule of thumb for a model with a high degree of freedom (DF), the acceptable threshold to ensure a well-fitting model for the $\chi2/DF$ ratio is in the range of 2–5 (Kelloway, 1998). A value greater than 0.9 is suggested as a reasonable model fit for fit indexes such as the CFI, IFI, and NFI (Bentler and Bonett, 1980). The acceptable value proposed for the RMSEA to ensure that the model fits is less than 0.08 (Browne and Cudeck, 1993). Therefore, the results of the fit indices reveal a good fit of the model.

Regression analysis using a structural equation model in IBM SPSS AMOS 25 was applied to test the hypotheses. Table 3 shows unstandardized maximum likelihood estimates, including the structural paths, estimates, standard error of regression weight estimates (S.E.), critical ratios (C.R.), and P-values. As shown in Table 3, there is no significant direct structural path between exogenous and endogenous variables. Therefore, there is no significant direct effect between digital transformation and relationship performance (C.R. = -1.952; P = 0.051), which means that the first hypothesis is not supported. As suggested by Baron and Kenny (1986), the full mediation is supported when the direct effect of the exogenous variable on the endogenous variable is not significant, and the mediating variable significantly affects the endogenous variable. As shown in Table 3, digital transformation does not have a significant effect on relationship performance (C.R. = -1.952; P = 0.051), but digital transformation has a significant direct effect on smart technologies (C.R. = 8.130; $P \le 0.001$), and smart technologies have a significant effect on relationship performance (C.R. = 3.616; $P \le 0.001$), which means the second hypothesis is supported. Therefore, the results reveal a full mediation effect of smart technologies between digital transformation and relationship performance.

5. Discussion and conclusion

5.1. Theoretical implications

This study investigated the mediating effect of smart technologies on the connection between digital transformation and relationship performance. Thus, the study provides evidence to suggest that investment in smart technologies can provide firms with substantial relationship benefits. Therefore, the study contributes to research on the digital supply chain (Scuotto et al., 2017; Büyüközkan and Göçer, 2018). As a first contribution, the findings show that digital transformation of companies alone does not have a direct effect on relationship performance. This is in line with the previous research that mentioned the importance of comprehensive procedures, strategies, and tools to experience benefits from the digital supply chain (Akter et al., 2016; Büyüközkan and Göçer, 2018; Matt et al., 2015; Weichhart et al., 2016; Zhu et al., 2015). The reason might be that digital transformation alone does not create value in the relationships, as digitality requires strategy and goals. Furthermore, digitality can be adopted into organizations quite easily without thinking about the benefits and effectiveness of its implementation (i.e., the actual use of digitality in managing the company). In other words, before redesigning a business in the digital age, there is a need to think about the type of business and the appropriate digital procedures for implementation.

Second, the results support the claim that smart technologies mediate the relationship between digital transformation and relationship performance, covering both internal and external aspects. Therefore, when companies couple smart technologies with digital transformation, the impact on relationship performance will be enhanced. This is in line with previous research that mentioned building stronger collaboration in digital transformation through smart technologies (Berman, 2012; Matt et al., 2015). Furthermore, many different researchers stated the determinant role of smart technologies in combining software and software components, and mixing content across platforms, infrastructures, and production systems (Langlois, 2003; Merrifield et al., 2008; Yoo et al., 2010; Kallinikos et al., 2013). According to Merschbrock and Mundvold (2015), there is a need for a collaborative work environment that facilitates interactions. In this regard, it is worth mentioning that smart technologies provide a concrete tool to implement digital transformation in a company. Additionally, in order to adopt smart technologies (as it is challenging and time-consuming), companies need to have certain skills and an understanding of what they seek to accomplish with the technology. Consequently, the benefits (in terms of relationship performance) will follow. With regard to the perspective of the dynamics of the digital supply chain, it can be presented that smart technologies stimulate the growth in relationship performance. This stimulation may occur when smart technologies are integrated into the current supply chain or when smart technologies entirely or partially replace the existing supply chain.

5.2. Managerial implications

This study increases awareness and understanding of the scant previous studies on the links between digital transformation of companies and smart technologies to achieve relationship performance. The empirical evidence of the study showed that digital transformation provides many opportunities for organizations to support smart technologies, leading to relationship performance. Thus, the managers of SMEs should invest in different types of smart technologies that may improve relationship performance in the supply chain. Because smart technologies help transform digitality into value for relationships throughout the supply chain. Additionally, this study provides guidance for managers of SMEs on how to develop relationship performance in the digital supply chain. This study suggests that managers considering digital transformation should focus on how this phenomenon integrates with current systems to support their relationship performance. While the vast number of firms might be able to implement digitalization in their business, turning this phenomenon into opportunities to enhance both internal and external relationship performance will likely necessitate the investment in smart technologies to support and complement firm strategies.

5.3. Limitations and further research

There are some limitations in this study, which create opportunities to promote more research on this topic. First, cross-sectional data and a lack of longitudinal data might threaten an in-depth analysis of the data to find the required approaches in the digital supply chain. Second, collecting data from a single country (Finland) and analyzing them based on managerial perceptions could introduce bias and a lack of generalizability into the findings of the research. In future studies, it can be suggested to conduct research in different countries and to utilize multiple respondents from different departments of the companies. Lastly, the only endogenous variable in this study is relationship performance, which creates opportunities to expand the theoretical model of this study for other performance measures, including sales and market shares, as well as business brand and image, in terms of studying them as other endogenous variables.

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